ST425

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SERVICE MANUAL

ST425 WINCHESTER DISC DRIVE SERVICE MANUAL

June 28, 1984

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1.Ø INTRODUCTION

The ST425 is Seagate's 25.52 Megabyte, 5 1/4 inch Winchester disc drive. The ST425 has a formatted capacity of 2Ø.Ø Megabytes.

The ST425 is the newest addition to the ST4ØØ family of disc drives, and has the same interface, power supply and controller requirements as the industry standard Seagate ST4Ø6/412/419 series.

Minislider heads and an advanced stepper motor design enable higher track density. The new head design allows increased bit packing which utilizes more of the disc surface. High reliability is assured through the use of Seagate's proven metal band-actuator, stepper motor head positioner and a direct-drive brushless DC spindle motor. The spindle motor assembly is dynamically balanced and the Head Disc Assembly (HDA) is shock-mounted to reduce vibration.

The low mass/load force of the MiniWinchester heads and the lubricated oxide coated media provide reliable start/stop operation. Each disc surface is read by two read/write heads. The HDA, which includes the read/write heads, discs and band-actuator assembly, is completely sealed and protected by a captured-air-space recirculation system employing a Ø.3 micron absolute filter. A filtered port permits ambient air pressure equalization.

Thermal stabilization delays are unnecessary with the ST425. The spindle pump assures adequate air flow and uniform temperature distribution throughout the HDA. This allows significantly greater off-track margin and immediate read/write ability after power-up.

Only DC voltages (+5 and +12 V DC) are required. All electronics are packaged a single printed circuit board. The board is mounted outside the sealed media area allowing easy field access without risking media integrity. Simplification of mechanical and electrical design provides a projected service life of more than 11,ØØØ hours Mean Time Between Failures (MTBF).

1.1 SPECIFICATION SUMMARY

1.1.1 Physical Specifications

Environmental Limits

Ambient Temperature Limits

Operating:	50o to 113oF (10o to 45oC)
Non-Operating:	-40o to 140oF (-40o to 60oC)

Maximum Temperature Gradient

Operating:	18oF/hour (10oC/hour)
Non-Operating:	Below Condensation

Relative Humidity: 8 to 80% non-condensing

Maximum Wet Bulb: 78.8oF (26oC)

Maximum Elevation

Operating:	-1,000 feet to 10,000 feet
Non-Operating:	-1,000 feet to 30,000 feet

Maximum Shock Without Incurring Physical Damage

[11 msec shock pulse, half sine wave]

Operating:	
Longitudinal:	3 G's
Lateral:	5 G's
Vertical:	7 G's
Non-Operating:	35 G's

No mechanical damage will occur within the above specified limits.

Maximum Vibration Without Incurring Soft Errors:

Operating: Frequency	
2--22 Hz	.010" double amplitude
22-500 Hz	0.25 G (peak)
500--22 Hz	0.25 G (peak)
22---2 Hz	.010" double amplitude

Maximum Vibration Without Incurring Physical Damage.

Non-operating: Frequency	
2--22 Hz	.040" double amplitude
22-500 Hz	1.0 G (peak)
500--22 Hz	1.0 G (peak)
22--2 Hz	.040" double amplitude

DC Power Requirements

+12 Volts ±5%	1.6 A Typ., 3.5 A (at power-on)
+5 Volts ±5	1.1 A Typ., 1.7 A (Max.)
Maximum Ripple:	50 mV peak to peak (12 V, 5 V)

Heat Dissipation

Typical:	25 Watts
Maximum:	29 Watts

Mechanical Dimensions

Height:	3.26 inches Maximum
Width:	5.75 inches
Depth:	8.00 inches
Weight:	4.6 pounds [2.1 Kg]
Shipping Weight:	7.0 pounds [3.2 Kg]

1.1.2 Reliability Specifications

MTBF:	11,000 POH @25°C Typ. usage
MTTR:	30 minutes
PM:	Not required

The component design life is 5 years.

Read error Rates (Based on bit-jitter reduction)

Soft Read Errors*:	1 per 10^{10} bits read
Hard Read Errors**:	1 per 10^{12} bits read
Seek Errors:	1 per 10^{6} seeks

Bit-jitter reduction determines the relationship between the leading edge of read data and the center of the data window. The data separator must provide at least -40 dB of bit-jitter reduction at 2F with an offset error of 1.5 nsec shift from the center of the data window.

* Recoverable within 16 retries
** Not recoverable within 16 retries

1.1.3 Performance Specifications

CAPACITY	**FORMATTED**	**UNFORMATTED**
Per Drive:	20.0 MB	25.52 MB
Per Surface:	5.0 MB	6.38 MB
Per Track:	8,192 Bytes	10,416 Bytes

Access Time:

Seek Times Including Settling
Single Track: 19.67 msec

Buffered Seek (from last Step pulse to SEEK COMPLETE)
Average Seek: 65 msec
Full Seek: 140 msec

Transfer Rate: 5.0 MBits/sec
Average Latency: 8.33 msec

1.1.4 Functional Specifications

Rotational Speed:	3,600 RPM ±1%
Recording Density:	10,568 Bits per inch (Maximum)
Flux Density:	10,568 Flux changes per inch (Maximum)
Track Density:	550 Tracks per inch
Cylinders:	306
Tracks:	2,448
Read/Write Heads:	8
Discs:	2

2.Ø THEORY OF OPERATIONS

2.1 General Interface Description

The ST425 Winchester supports the Seagate ST5Ø6/412 Interface.

The interface consists of a 34 pin control connector, a 2Ø pin read/write connector and a 4 pin DC connector. The 34 pin connector provides 1Ø control signals to the drive and returns 5 status signals to the controller. The 2Ø pin connector handles the Modified Frequency Modulation (MFM) data to/from the drive and supplies the drive-selected status to the controller. The 4 pin connector provides +5 and +12 Volts DC.

In general, the control connector is "daisy-chain" terminated throughout the user system, while the read/write connector is terminated radially. The following tables indicate the ST425 interface requirements.

J1/P1 - CONNECTOR PIN ASSIGNMENTS

GROUND RTN. PIN	SIGNAL PIN	DESCRIPTION
1	2	RESERVED
3		-HEAD SELECT 2^2
5	6	-WRITE GATE
7	8*	-SEEK COMPLETE
9	10*	-TRACK Ø
11	12*	-WRITE FAULT
13	14	-HEAD SELECT 2^0
15	16	RESERVED (To J2 Pin 7)
17	18	-HEAD SELECT 2^1
19	20*	-INDEX
21	22*	-READY
23	24	-STEP
25	26	-DRIVE SELECT 1
27	28	-DRIVE SELECT 2
29	30	-DRIVE SELECT 3
31	32	-DRIVE SELECT 4
33	34	-DIRECTION IN

*Status enabled with DRIVE SELECT or Radial Option

J2/P2 - CONNECTOR PIN ASSIGNMENTS

GROUND RTN. PIN	SIGNAL PIN	DESCRIPTION
2	1	-DRIVE SELECTED
4	3	RESERVED
6	5	RESERVED
8	7	RESERVED (To J1 Pin 16)
10	9	NOT CONNECTED
12	11	GROUND
	13	+MFM WRITE DATA
	14	-MFM Write Data
16	15	GROUND
	17	+MFM READ DATA
	18	-MFM READ DATA
20	19	GROUND

J3/P3 - CONNECTOR PIN ASSIGNMENTS

PIN 1	+ 12 VOLTS
PIN 2	+ 12 VOLTS RETURN
PIN 3	+ 5 VOLTS RETURN
PIN 4	+ 5 VOLTS

2.1.1 Recording Format

The ST425 uses Modified Frequency Modulation (MFM) as the encoding method to record data. This double-density encoding scheme increases disc capacity by replacing clock bits with data bits. Clock bits are written only when data bits are not present in both the preceding and current bit cell. Clock bits are written at the beginning of the bit cell, while data bits are written in the middle.

Due to predictable bit-shift phenomena, the ST425 requires pre-compensation of write data on cylinders 128 through 305. This function must be provided by the controller to ensure data integrity at the specified error rate. The data pattern determines which bits must be pre-compensated. The recommended amount of pre-compensation is 12 nsec for both early and late written bits. All other data patterns are written on time.

2.1.2 Track Format

The ST425 uses a slightly modified version of the IBM System-34 double-density format. This format is common to many industry standard floppy-disc drives.

When formatted, each sector is identified by a unique identification field, containing cylinder, head and sector information, address mark and error checking polynomials. The Seagate format uses Cyclic Redundancy Checking (CRC) for error correction. This format also allows for a plus or minus speed variation of aproximately 3%. The specification for spindle speed variation is 1% over the specified environmental and power limits.

2.1.3 Read/Write Heads

When operational, the read/write heads fly on an air bearing created by the rotating disc. There is no dedicated landing zone. The head and flexure (supporting arm) are designed for contact start/stop operation.

The Winchester heads are loaded toward the disc surface at 9.5 ±1 grams. This is a typical value to allow the required stability in all operating conditions. A typical flying height measured at an inner radius is 15 ±2 microinches. At an outer radius the height is 25 ±3 microinches.

The head/flexure assembly incorporates a low mass design that is resistive to head and/or media damage.

2.1.4 Discs

The ST425 employs two non-removable double-sided 5 1/4 inch discs. These discs are designed using current iron oxide technology. Disc dimensions are 40mm inside diameter by 130mm outside diameter. The thickness of the magnetic coating is 20 microinches at the ID and increases linearly to 40 microinches at the OD.

The disc surface is coated with a flourocarbon lubricant 25 to 55 Angstroms in thickness. The lubricant has sufficient abrasion resistance to withstand a minimum of 10,000 start/stop cycles.

2.1.5 Air Filtration System

The ST425 incorporates a captured-air-space air filtration system. The 0.3 micron filter maintains Class 100 standards within the sealed Head Disc Assembly (HDA) and requires no maintenance during the life of the drive. A filtered port allows ambient pressure equalization. During normal operation there is no measurable air flow between the HDA and the outside environment.

2.2 Mechanical Theory

2.2.1 Track 0 Sensor

The Track 0 optical interrupter provides an output whenever the Winchester heads are positioned over Cylinder Zero. This signal is used by the internal drive control electronics during the power-on/auto-recalibrate routine. The Track 0 signal is also output to the drive interface for use by the controller. Note that the signal at the interface is really Track 0/Phase A. The

2.2 Mechanical Theory

2.2.1 Track Ø Sensor

The Track Ø optical interrupter provides an output whenever the Winchester heads are positioned over Cylinder Zero. This signal is used by the internal drive control electronics during the power-on/auto-recalibrate routine. The Track Ø signal is also output to the drive interface for use by the controller. Note that the signal at the interface is really Track Ø/Phase A. The Track Ø optical interrupter incorporates an infrared LED and an infrared sensitive photo-transistor. When the heads are positioned at Track Ø, an interrupter arm attached to the stepper motor shaft breaks the light beam between the two components of the sensor. The sensor will output a valid Track Ø signal as long as the beam remains broken.

2.2.2 Index Sensor

Once each revolution the Index Sensor provides an index pulse to the microprocessor for recalibration. The ST425 Index Sensor is of the reluctance transducer type. The sensor incorprates a built-in preamplifier. The case of the sensor is grounded, which ties the drive DC returns to the drive casting.

The hub of the spindle motor has two metal tabs attached. One is ferrous and the other, which is mounted 180° is non-magnetic. Each revolution of the spindle motor causes the ferrous tab to rotate past the sensor, thereby inducing a pulse.

Note: Please do not attempt to set the Index Sensor gap without referring to the appropriate section in the field service section of this manual.

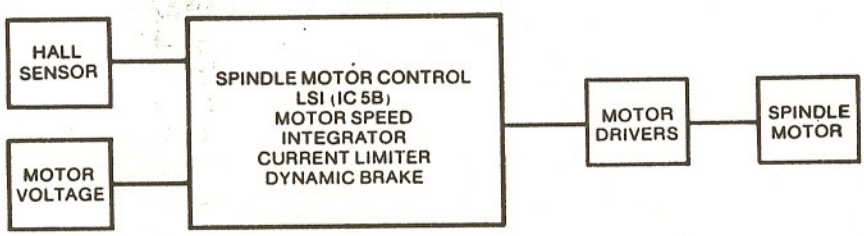
2.2.3 Ground Spring

The ST425 incorporates a grounding contact between the spindle motor hub and the PC Board ground plane.

2.3 Electrical Theory - Main Control PC Board 20321-001

2.3.1 Motor Speed Control

Block Diagram -



Refer to schematic on page 23.
The sequence of normal operations is as follows:

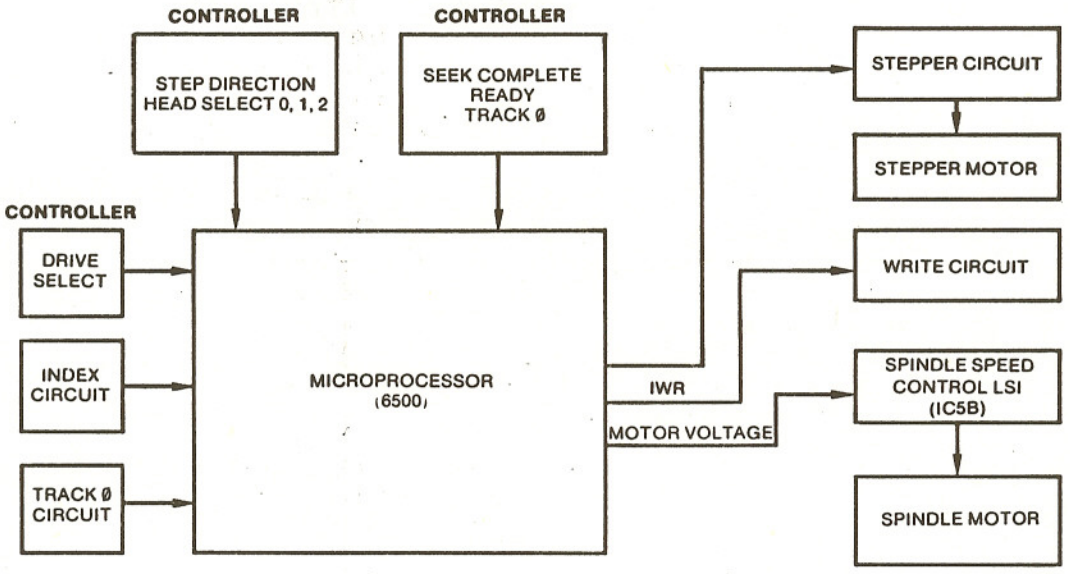
Hall Effect Transducer
Located inside the spindle hub, This magnetic transducer senses spindle position and provides dynamic feedback proportional to the speed of the motor. Two complete square waves are generated each motor revolution. This positional information is supplied to the spindle motor control LSI (IC 5B,pin 3). To prevent both phases of the motor from being selected simultaneously, the motor control LSI inverts the Hall input to coil A.

Spindle Motor Control LSI
When current is applied, the spindle motor control LSI sets the motor speed to 3,600 RPM nominal. This LSI integrates and transforms the error messages from the Hall effect transducer. Using this information, it outputs the correct current flow each revolution and corrects the motor phase driver at output pins 6 and 7.

When power is interrupted, the Motor Control LSI shorts both phases of the motor to ground, allowing the motor generated back-EMF to bring the spindle to a stop.

2.3.2 Microprocessor Operation

Block Diagram -



Functional Description -

The ST425 uses a microprocessor to monitor and control internal drive functions and host interface lines. The MPU has only three active modes: **Initializing, Seeking or Waiting.**

At power-on, the MPU initializes the stepper circuit to phase A and resets all interface lines under its control. Power is then applied to the Spindle Motor Control LSI and the index line is monitored for spindle rotation. If rotation is not sensed within 15 seconds, the MPU assumes a problem and removes power.

As the drive spins-up, 660 revolutions are counted before the MPU assumes that the drive is "at speed," and initiates recalibration. If the heads are not over Track Ø, the drive will step at 3 msec per track. When both mechanical Track Ø and electrical phase A are present, the drive is at true Track Ø and stepping will cease.

Within 20 msec both SEEK COMPLETE, TRACK Ø and READY will go true, and the drive is then ready to accept inputs from the controller.

When in the idle mode, the MPU loops, waiting for step pulses. The MPU also monitors its RESET line (pin 39) for a low to high signal,from IC 4F, which causes the MPU to reinitialize (see above).

Upon receiving a Step pulse, the MPU pauses for 500 usec, to allow for additional pulses, before executing the seek operation. Every incoming pulse resets the 500 usec timer. The seek operation will not begin until the last pulse is received.

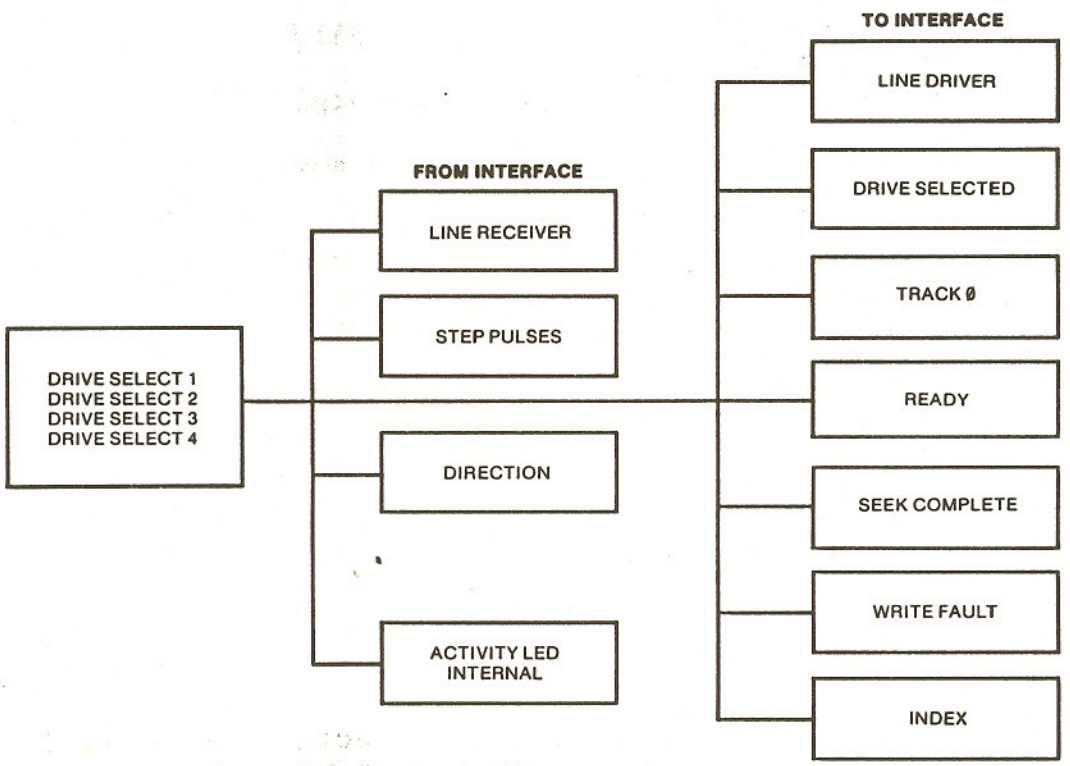
When seeking, the MPU evaluates the number of tracks to be covered and searches the PROM for the most efficient path. Seeks longer than seven tracks involve a complex acceleration/deceleration routine to optimize the motor and carriage characteristics. Steps are accomplished by setting IC 2B to sequential phases. It provides both a current source and sink with the motor winding. Near the end of a seek, 2D and 2E are set to provide additional current to offset expected hysteresis.

Upon completion of a seek operation, settling time is calculated based upon the length of seek, and the interface line is activated in the specified time period. With SEEK COMPLETE, the MPU returns to the idle mode.

Whenever a seek operation crosses the write current switch boundary at Track 128, the microprocessor reduces the write current to the heads during write operations.

2.3.3 Drive Selection

Block Diagram -

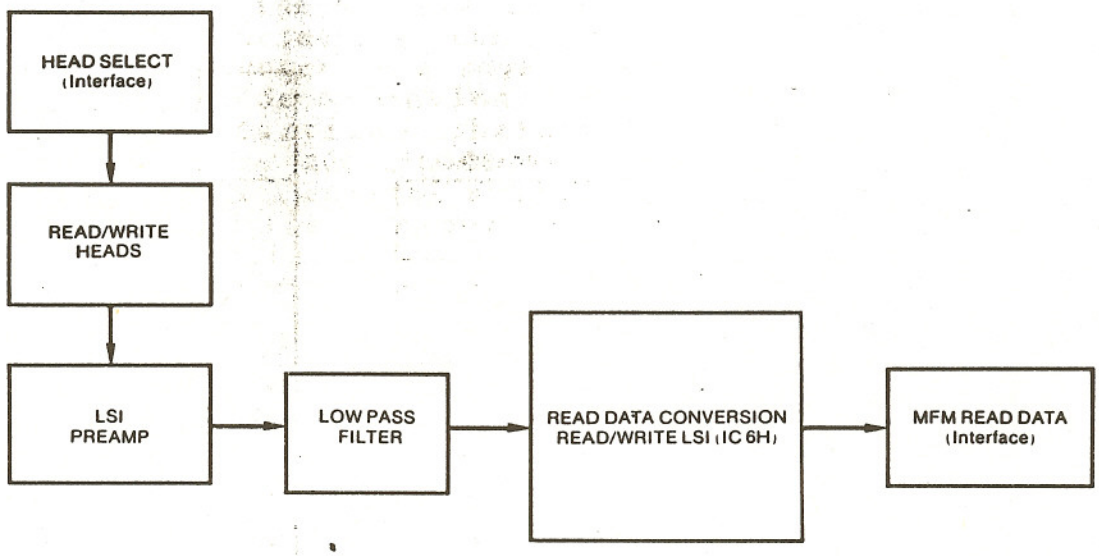


Functional Description -

DRIVE SELECT serves only to gate other signals to or from the drive interface. Without DRIVE SELECT, the drive cannot Read, Write or Seek.

2.3.4 Read Operation

Block Diagram -



Functional Description -

Head Select
The binary decoder, IC 2F, selects the desired head based on the status of the 3 head select lines. If the DC voltages are too low (possibly causing an inaccurate write operation), pin 12 will force the decoder to choose a nonexistent head. During read operations the head center tap is set at approximately 5 Volts by the Read/Write LSI, IC 6H, pin 27. By referencing Ø to +5 Volts, actual ground appears as -5 Volts, which eliminates the necessity of a negative power source normally required by the LSI preamp, IC 4G.

LSI Preamp
With the head center tap active, data from the selected head will flow into the preamp. This preamp amplifies the read signal and also acts as a high pass filter.

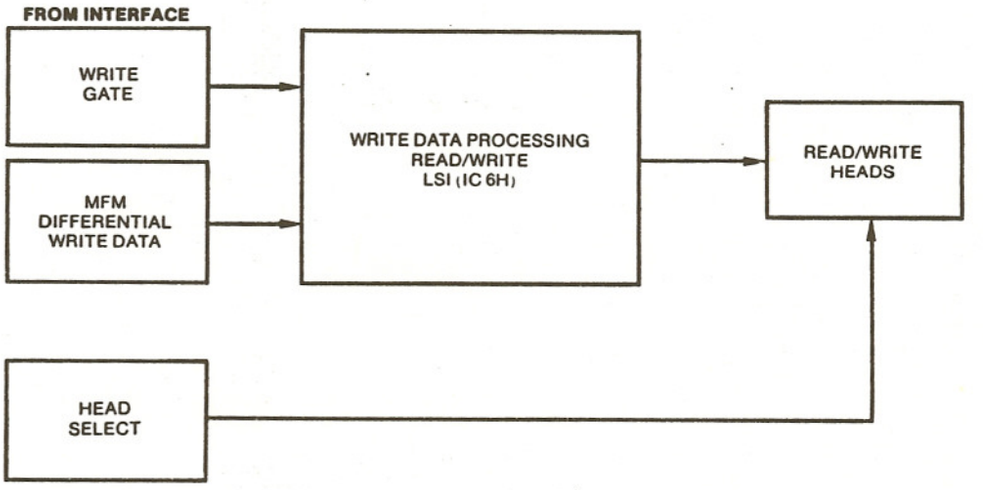
Low Pass Filter
This filter network attenuates high frequency noise, which is outside the normal data signal range.

Read Data Conversion
Amplified data enters the Read/Write LSI (IC 6H) at pins 1 and 2 and exits as high speed MFM (differential) read data at pins 17 and 18. The Read/write LSI functions are:

1. Read data shifted 90°
2. Analog to digital conversion
3. Erroneous data bits removed
4. Conversion of digital data to MFM (differential) data providing immunity to common mode noise during transmission

2.3.5 Write Operation

Block Diagram -



Functional Description -

In order to WRITE, the following conditions must be true:

1. Write Fault inactive
2. Drive Select active
3. Drive Ready active
4. Seek Complete active
5. Write Gate active

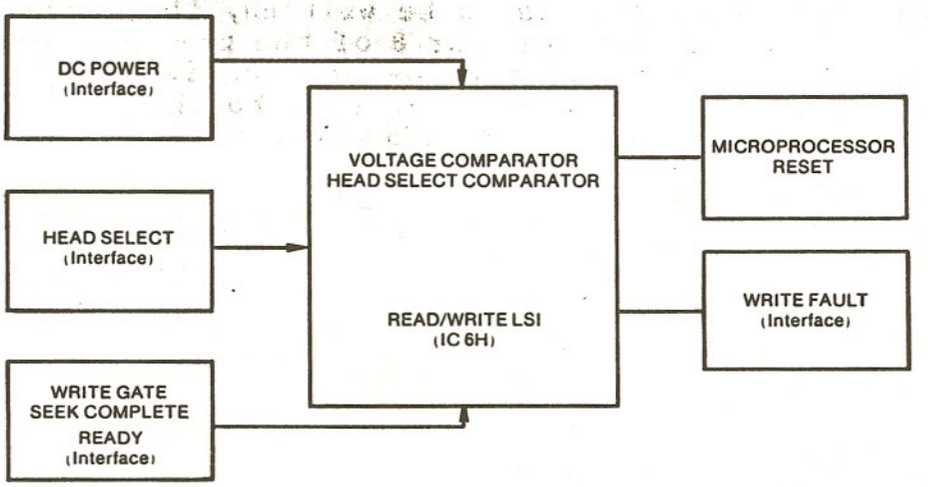
Write Gate
A write sequence is initiated when Write Gate is activated which causes the Read/Write LSI (IC 6H, pin 26) to apply +12 Volts to the selected head's center tap. At the same time, data is sent to the Read/Write LSI, pins 15 and 16.

Write Data Processing

Differential write data, which is precompensated MFM, is received from the host controller by the Read/Write LSI and changed to single line pulse data. Depending whether plus or minus data is to be written, the Read/Write LSI activates either pin 7 or 8 of the pre-amp LSI (IC 4G). The amount of current to be written is established by the Read/Write LSI. When writing to the inner heads (2 and 3), write current is reduced to lessen the problems of pulse crowding.

2.3.6 Fault Detection

Block Diagram -



Functional Description -

Any combination of the following events will cause a Write Fault condition and will prevent the drive from writing:

1. Multiple heads selected

2. DC voltages greater than 20% low

3. Seek Complete or Ready inactive when Write Gate is active

Voltage and Head Comparator Select
The Read/Write LSI (IC 6H) constantly monitors both the +5 and +12 Volt lines to detect a low-voltage condition. If +5 Volts is >15% low or +12 Volts is >20% low, the DC-unsafe signal is activated (IC 6H,pin 25) causing write current to be disabled, the microprocessor reset, the fault line activated (IC 6H, pin 24) and the heads deselected.

If multiple heads are selected the Read/Write LSI will disable the write circuitry and send a write fault to the interface (IC 6H, pin 24).

2.4 Test Points

2.4.1 Test Point Data PC Board 20321-001

Test Points 1 and 2 (Differential Read Filter):

Test Points 1 and 2 may be used to observe the Differential Read Data. The typical amplitude of the signal resulting from adding the two channels is 160 mVolts. The signal is observed at Cylinder Zero, head 0 or 1.

A full track record of high frequency data (0000 or 1111) should resemble the diagram in Figure 2.0.

Test Point 4 (Track 0 Sensor):

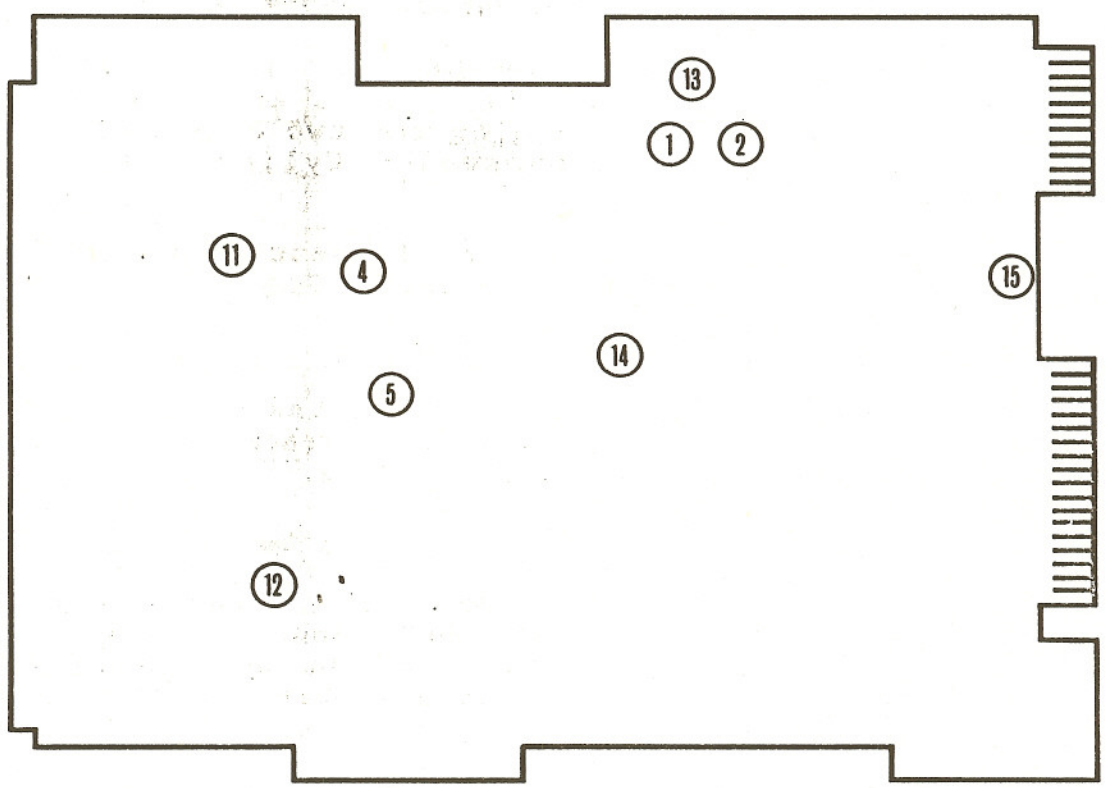
Test Point 4 may be used to monitor the Track 0 Sensor. A high logic level indicates valid Track 0. The Track 0 signal is valid for Cylinders 1 and 2.

Test Point 5 (Index Sensor):

Test Point 5 may be used to monitor the Index Sensor. A high logic level is a valid Index indication. Only the leading edge of the pulse may be considered valid. The typical signal at TP 5 should resemble the diagram in Figure 2.0.

Test Points 11, 12, 13, 14 and 15 are ground.

FIGURE 1.Ø
TEST POINT LAYOUT PC BOARD 2Ø321-ØØ1



TEST POINT	DESCRIPTION
1 & 2	Differential Read Filter
4	Track Ø Sensor
5	Index Sensor
11,12,13,14,15	Ground

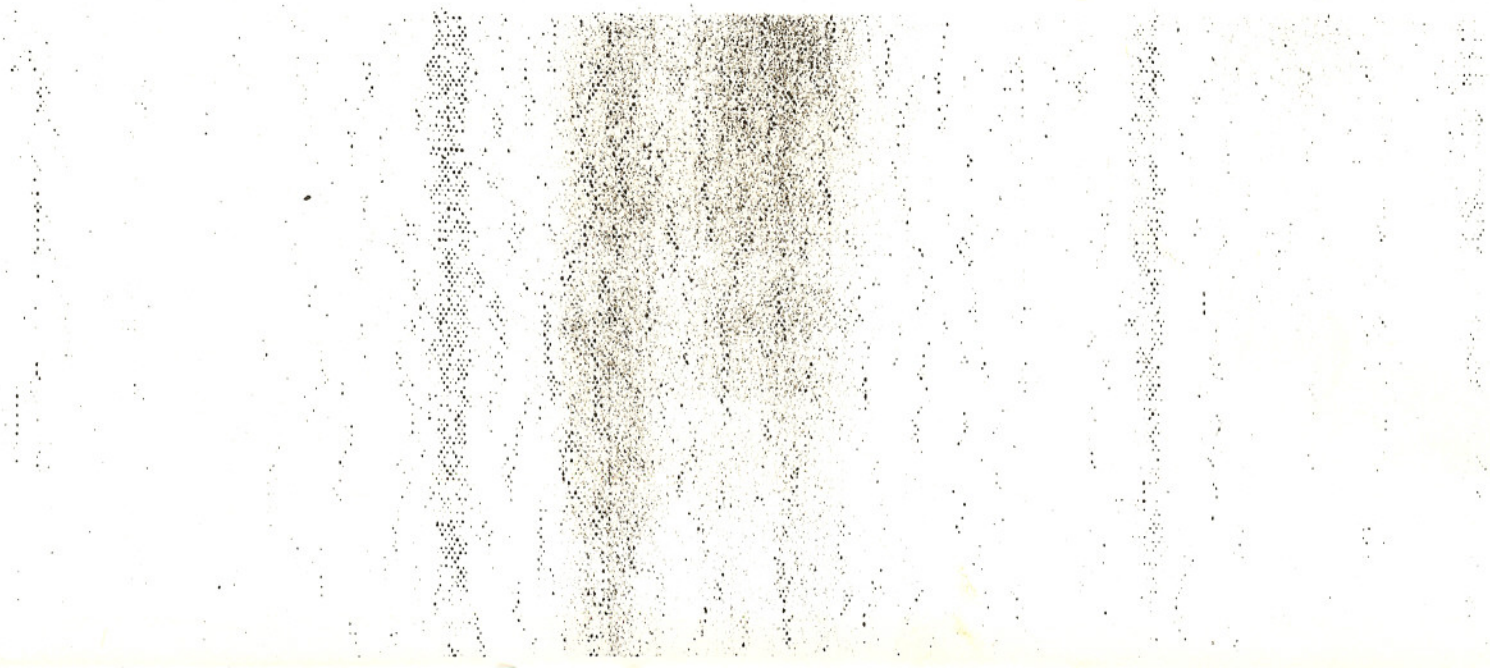
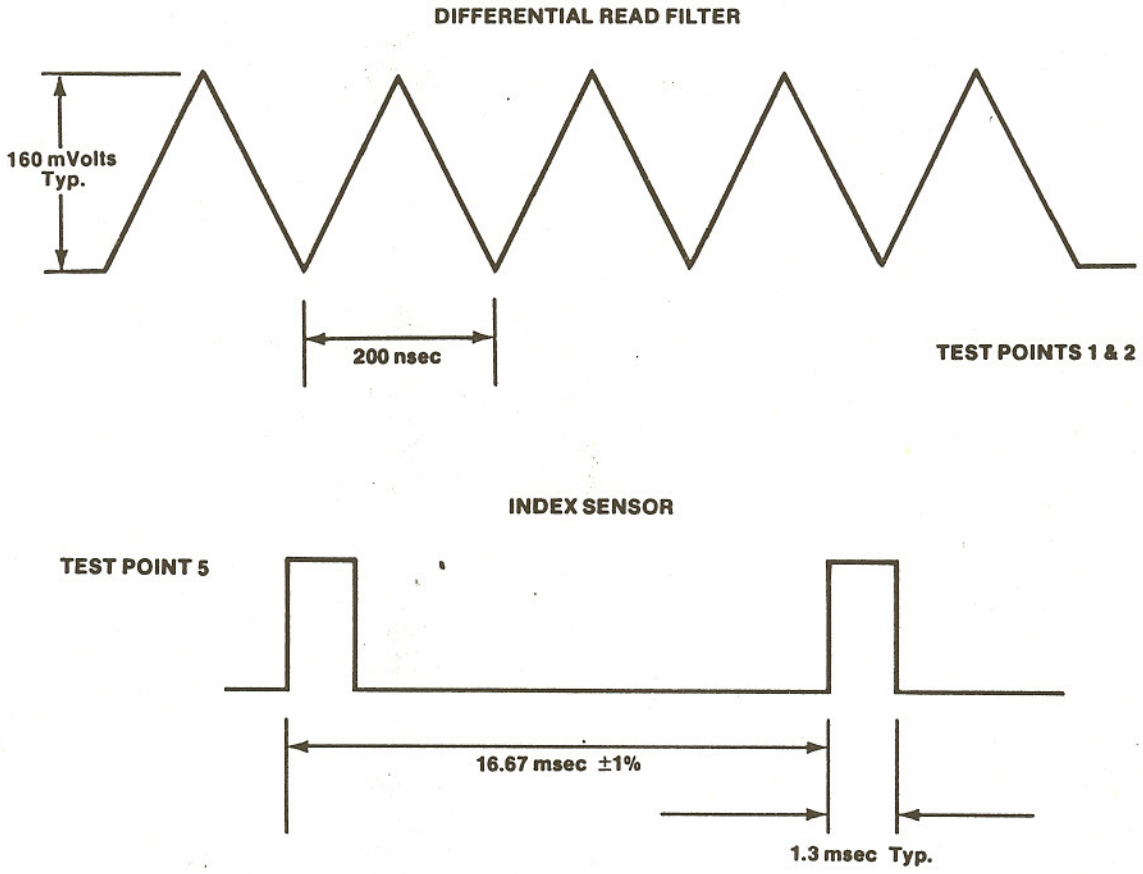


FIGURE 2.0
TEST POINT TIMING PC BOARD 20321-001



2.5 ST425 SCHEMATICS

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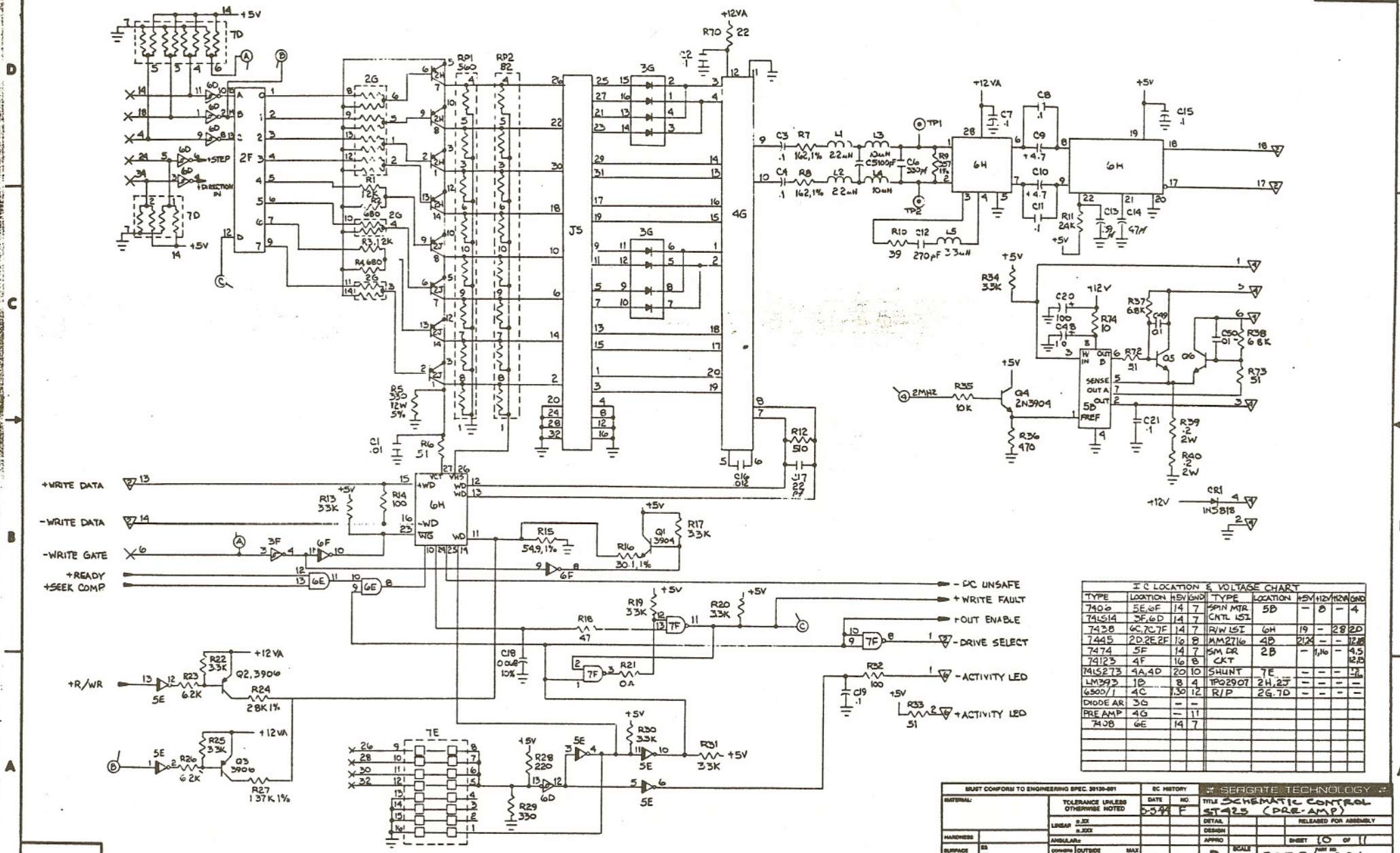
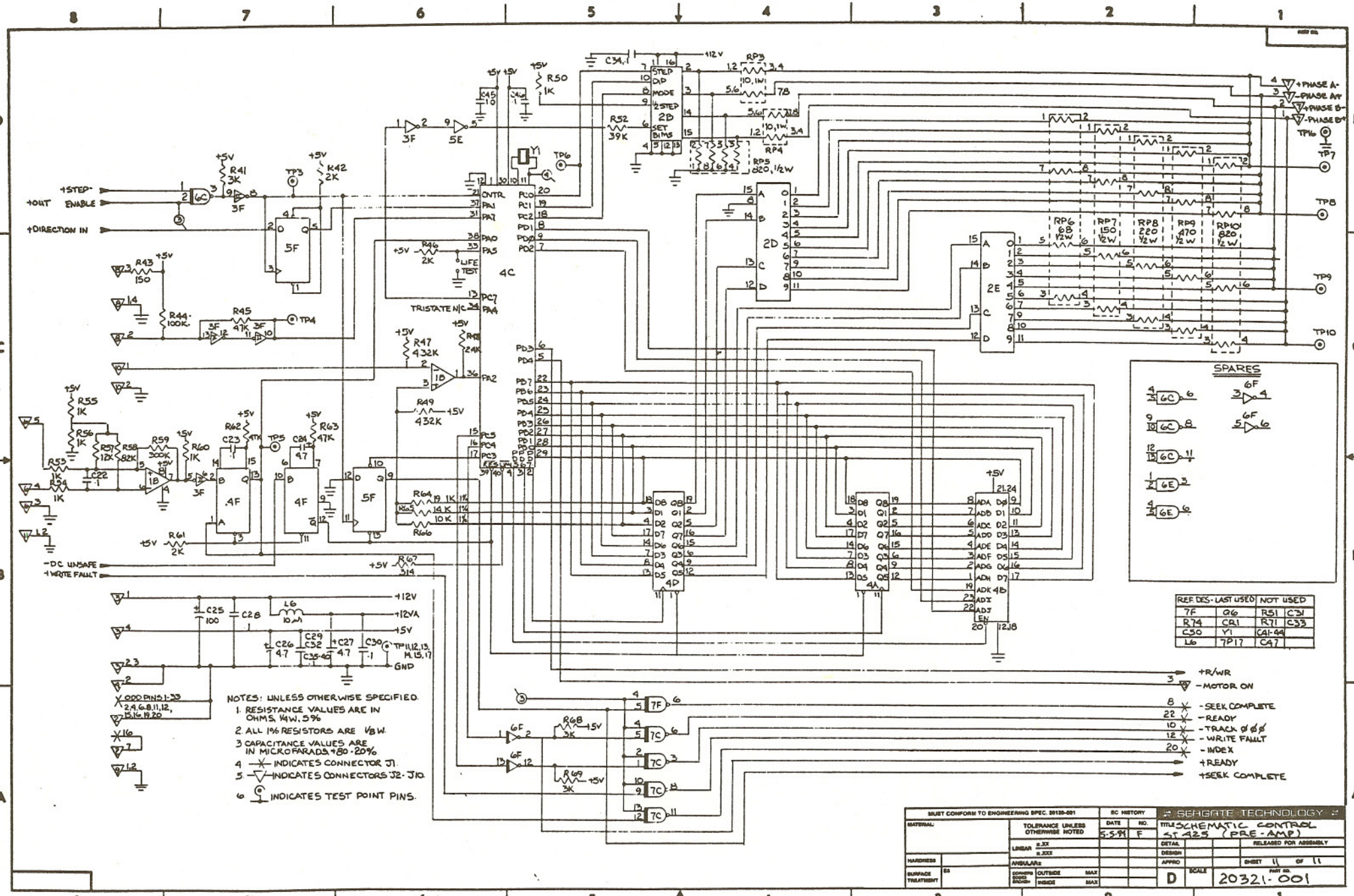


I C LOCATION & VOLTAGE CHART									
TYPE	LOCATION	+5V	GND	TYPE	LOCATION	+5V	+12V	+12VA	GND
7406	5E,6F	14	7	SPIN MTR. CNTL LSI	5D	—	8	—	4
74LS14	3F,6D	14	7						
7438	6C,7C,7F	14	7	R/W LSI	6H	19	—	28	20
7445	2D,2E,2F	16	8	MM2716	4D	24	—	—	12.5
7474	5F	14	7	SM DR CKT	2B	—	1,16	—	4.5, 12.5
74123	4F	16	8						
74LS273	4A,4D	20	10	SHUNT	7E	—	—	—	7.5
LM393	1B	8	4	TP02907	2H,2J	—	—	—	—
6500/1	4C	1.30	12	R/P	2G,7D	—	—	—	—
DIODE AR	3G	—	—						
PRE AMP	4G	—	11						
7408	6E	14	7						

MUST CONFORM TO ENGINEERING SPEC. 30130-001	EC HISTORY	SEAGATE TECHNOLOGY	
MATERIAL:	TOLERANCE UNLESS OTHERWISE NOTED	DATE: 5-5-84 NO: F	TITLE: SCHEMATIC CONTROL ST-225 (PRE-AMP)
HARDNESS:	LINEAR: .X ±.03, .XX ±.02, .XXX ±.005		DETAIL: RELEASED FOR ASSEMBLY
SURFACE TREATMENT:	ANGULAR: ±		DESIGN:
	SCREW THREAD CLASS: OUTSIDE MAX, INSIDE MAX		APPRO: SHEET 10 OF 11
			D — 20321-001



REF DES	LAST USED	NOT USED	
7F	Q6	R51	C31
R74	CR1	R71	C33
C50	Y1	CR1-4	
L6	TP17	C47	

3.Ø FIELD SERVICE AND ADJUSTMENTS

SEAGATE disc drives do not require preventative maintenance. All units shipped are covered by a one year factory warranty. Should field service or adjustment become necessary, certain restrictions apply. Primarily, the sealed Head Disc Assembly (HDA) must not be opened. Seagate considers a drive to be out of warranty if the the HDA has been tampered with. Any special tools or additional cautions will be treated under the appropriate sections.

This section of the ST425 Service Manual covers adjustments and procedures concerning field-accessible components. Any questions not treated in this document should be referred to your regional Seagate Technical Support office. Field Support offices, and their phone numbers, are listed at the back of this handbook.

Should it become necessary to return a drive to Seagate, please ensure that the drive is shipped in the **original** container. If that is not possible, your Technical Support office will assist you in obtaining an approved container.

Please Note: Shipping a drive in an unapproved container could cause damage and will void your warranty!

3.1 Removals and Adjustments

Note: Removal of any assembly not covered in this section is not possible without special tools and clean-room facilities.

BEFORE PERFORMING ANY OPERATION LISTED BELOW, PLEASE PROVIDE A CUSHIONED WORK SURFACE.

3.1.1 PC Board

Tools Required: T-10 Torx Driver

1. Place the drive on a padded surface, PC Board up and with the front cover to your left.
2. Remove the front cover by removing (4) mounting screws.
3. Disconnect the Front panel LED by removing the two-wire connector.
4. Disconnect P6, P7 and P8, located at the left edge of the PC Board, noting their position.
5. Disconnect the Printed Cricuit Cable, J5, located at the upper edge of the PC Board (12:00 o'clock).
6. Disconnect the spindle motor cable, P4, located on the lower edge of the PC Board. (6:00 o'clock).
7. Slide the PC Board out to the right.

Note: It is recommmended that the replacement PC Board be powered-up with the head cable, P5, disconnected. This will ensure that a damaged replacement does not alter data on the disc. To determine if the Board is good, the Write Fault signal can be monitored at the junction of the inverter and R113. If a high logic level exists at junction R113, then a No-Write-Fault condition exists and the PCB can be powered down and P5 connected. Avoid creasing the Printed Circuit Cable when removing P5. Inspect the cable after this operation.

3.1.2 Index Sensor

Tools Required: T-10 Torx Driver,
Loctite #242, .030" shim

Note: This procedure may result in a loss of recorded data.

1. Remove the PC Board (see above).
2. The Index Sensor is mounted to the casting directly to the left of the spindle motor and may be removed by first freeing the LED connector from the front cover (noting its orientation) and then remove the Index Sensor clamp.

3. To reinstall, apply Loctite to the first three threads of the mounting screw. Replace the Sensor, clamp and screw, but do not tighten.
4. Rotate the spindle motor until the silver index tab aligns with the Index Sensor.
5. Using the .030" shim, adjust the gap between the Index Sensor and the index tab.
6. Tighten the mounting clamp screw and verify that the gap is .030 inch.
7. Route the Index Sensor wires through the retaining clip and reconnect the LED connector.
8. Replace the PC Board.

3.1.3 Ground Spring

Tools Required: T-10 Torx Driver
Loctite #242

1. Remove PC Board (see above).
2. With the front cover to your left, the Ground Spring is at "12:00 o'clock" to the spindle motor and may be removed using the T-10 Torx Driver.
3. When reinstalling, apply Loctite to the first 3 threads of the mounting screw.
4. Verify that the Ground Spring contact button and the spindle motor ball are clean and making positive contact.

3.1.4 Front Cover

Tools Required: T10 Torx Driver

1. Remove the PC Board (see above).
2. Remove the four front cover mounting screws.
3. Disconnect the LED connector, noting its orientation.
4. Remove the cover.

3.1.5 Front Cover LED

Tools Required: T-10 Torx Driver

Note: A water base hot-melt glue may be used to secure the LED/grommet assembly.

1. Remove the PC Board (see above).
2. Remove the connector from the Front Cover LED, noting the orientation of the connector.
3. Remove the LED and grommet from the Front Cover, noting the orientation of the LED.

3.1.6 Frame

Tools Required:T-1Ø Torx Driver

1. Orient the drive PC Board up and front cover to your left.
2. Remove the PC Board (see above).
3. Remove the Front Cover (see above).
4. Free the ground strap jumper (located on your right) from the frame.
5. Remove the three shock mounting screws and lift the frame up, leaving the Head Disc Assembly (HDA) on the padded surface. If it is necessary to transport the HDA, please keep it strapped down to the drive pallet to avoid excessive shocks.

3.1.7 Track Ø Sensor

Tools Required: T-1Ø Torx Driver

Proper positioning of the Sensor is essential. The adjusting set screw is set at the factory and should not be tampered with.

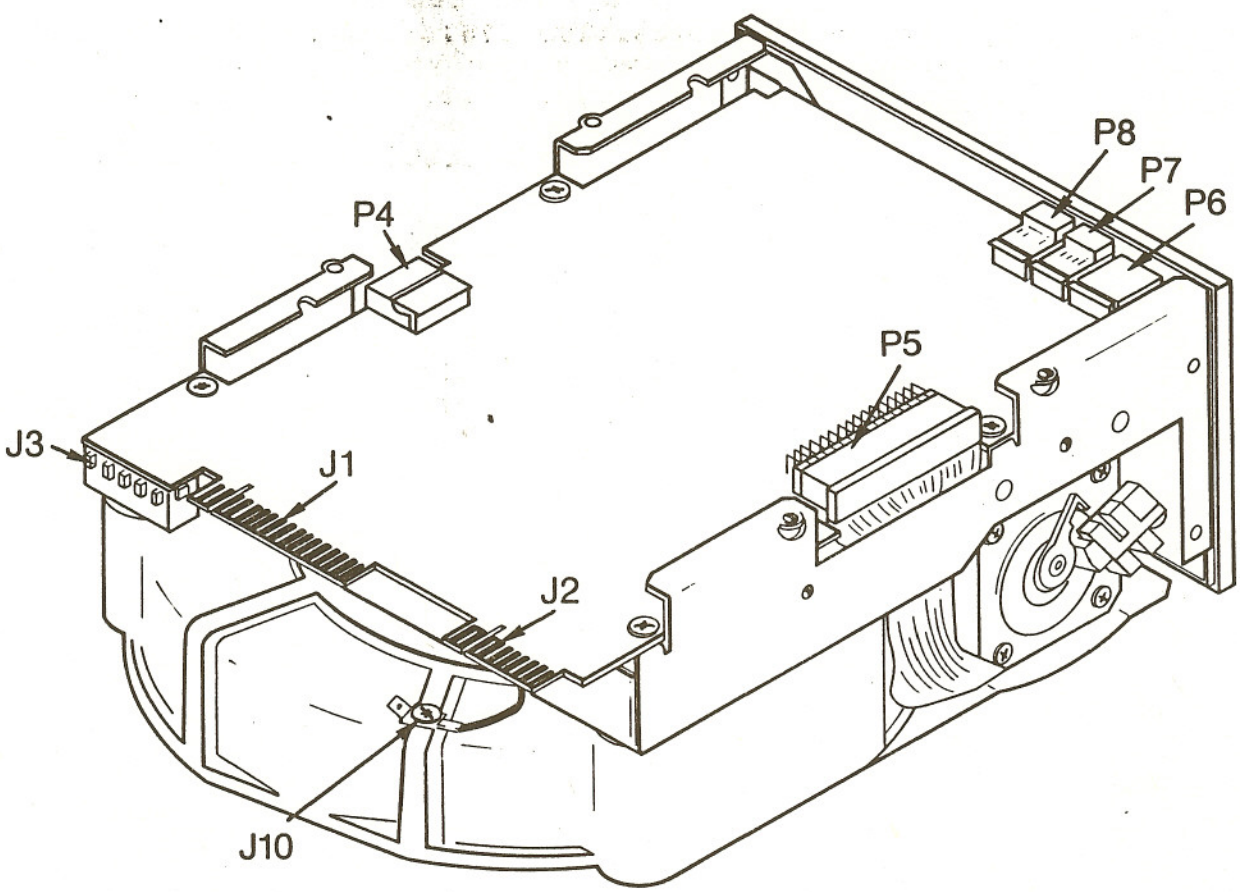
1. Remove the Front Cover (see above).
2. Disconnect P8.
3. Position the drive on edge with the stepper motor up.
4. Remove the Track Ø Sensor mounting screw, using the T-1Ø Torx driver.
5. Remove Sensor.
6. When reinstalling, apply Loctite to the first three threads of the mounting screw.

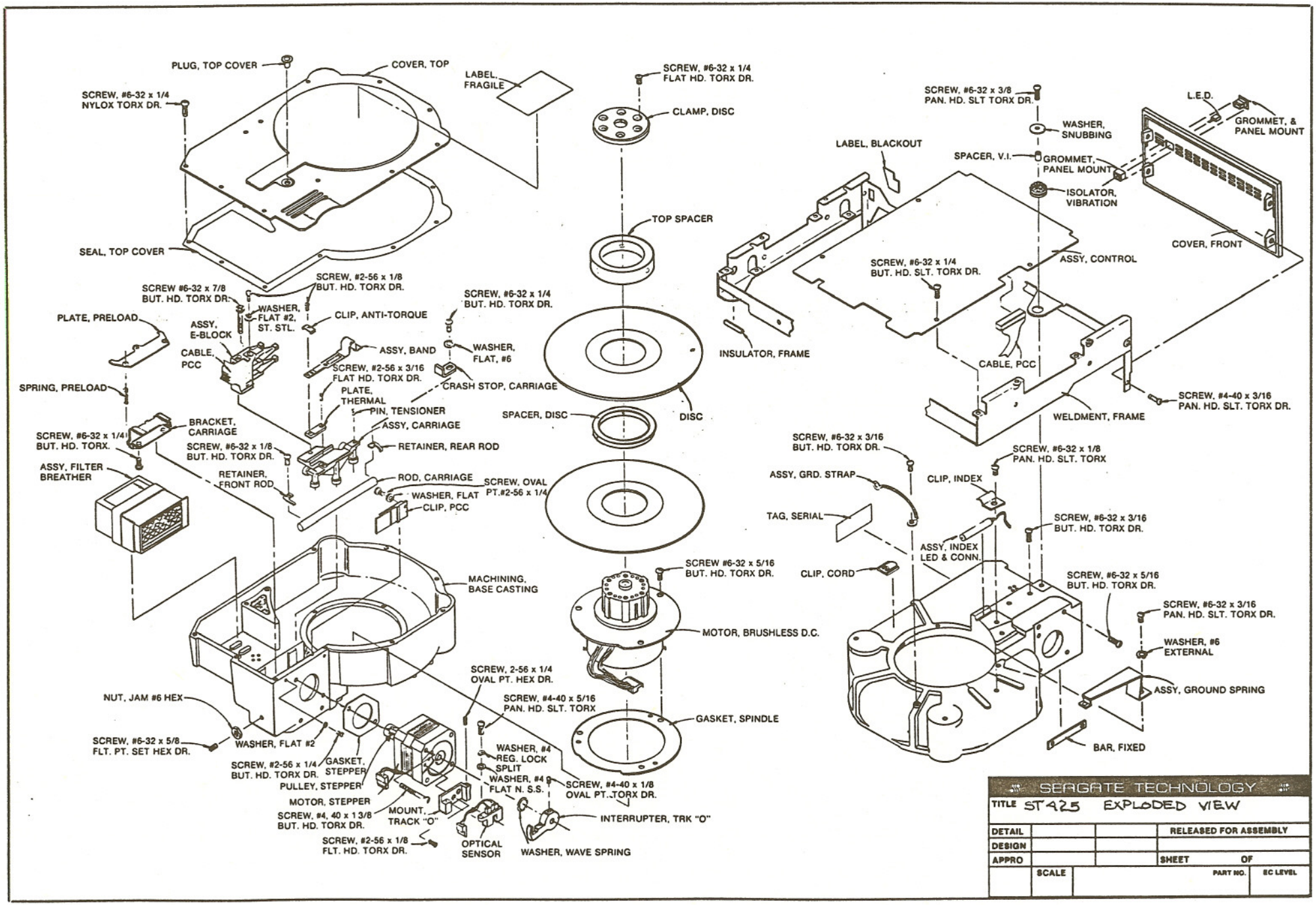
4.Ø ILLUSTRATED PARTS CATALOG

INDEX

SECTION	PAGE
4.1 Interface Connectors	3Ø
4.2 Exploded View	31
4.3 Component Locations	32
4.4 Parts List	33-34

FIGURE 3.Ø
INTERFACE CONNECTORS




PLUG, TOP COVER
COVER, TOP
LABEL, FRAGILE
SCREW, #6-32 x 1/4 NYLOX TORX DR.
SEAL, TOP COVER
SCREW, #6-32 x 1/4 FLAT HD. TORX DR.
CLAMP, DISC
TOP SPACER
DISC
SPACER, DISC
SCREW, #6-32 x 1/4 BUT. HD. TORX DR.
SCREW #6-32 x 7/8 BUT. HD. TORX DR.
WASHER, FLAT #2, ST. STL.
SCREW, #2-56 x 1/8 BUT. HD. TORX DR.
CLIP, ANTI-TORQUE
PLATE, PRELOAD
ASSY, E-BLOCK
CABLE, PCC
ASSY, BAND
WASHER, FLAT, #6
SCREW, #2-56 x 3/16 FLAT HD. TORX DR.
CRASH STOP, CARRIAGE
PLATE, THERMAL
PIN, TENSIONER
SPRING, PRELOAD
BRACKET, CARRIAGE
ASSY, CARRIAGE
SCREW, #6-32 x 1/4 BUT. HD. TORX.
SCREW, #6-32 x 1/8 BUT. HD. TORX DR.
RETAINER, REAR ROD
ASSY, FILTER BREATHER
RETAINER, FRONT ROD
ROD, CARRIAGE
SCREW, OVAL PT.#2-56 x 1/4
WASHER, FLAT
CLIP, PCC
MACHINING, BASE CASTING
SCREW #6-32 x 5/16 BUT. HD. TORX DR.
MOTOR, BRUSHLESS D.C.
GASKET, SPINDLE
SCREW, 2-56 x 1/4 OVAL PT. HEX DR.
SCREW, #4-40 x 5/16 PAN. HD. SLT. TORX
NUT, JAM #6 HEX
SCREW, #6-32 x 5/8 FLT. PT. SET HEX DR.
WASHER, FLAT #2
SCREW, #2-56 x 1/4 BUT. HD. TORX DR.
GASKET, STEPPER
PULLEY, STEPPER
MOTOR, STEPPER
WASHER, #4 REG. LOCK SPLIT
WASHER, #4 FLAT N. S.S.
SCREW, #4-40 x 1/8 OVAL PT. TORX DR.
SCREW, #4, 40 x 1 3/8 BUT. HD. TORX DR.
MOUNT, TRACK "O"
INTERRUPTER, TRK "O"
SCREW, #2-56 x 1/8 FLT. HD. TORX DR.
OPTICAL SENSOR
WASHER, WAVE SPRING
SCREW, #6-32 x 3/8 PAN. HD. SLT TORX DR.
L.E.D.
GROMMET, & PANEL MOUNT
WASHER, SNUBBING
LABEL, BLACKOUT
SPACER, V.I.
GROMMET, PANEL MOUNT
ISOLATOR, VIBRATION
COVER, FRONT
ASSY, CONTROL
SCREW, #6-32 x 1/4 BUT. HD. SLT. TORX DR.
INSULATOR, FRAME
CABLE, PCC
SCREW, #4-40 x 3/16 PAN. HD. SLT. TORX DR.
WELDMENT, FRAME
SCREW, #6-32 x 3/16 BUT. HD. TORX DR.
SCREW, #6-32 x 1/8 PAN. HD. SLT. TORX
ASSY, GRD. STRAP
CLIP, INDEX
TAG, SERIAL
SCREW, #6-32 x 3/16 BUT. HD. TORX DR.
ASSY, INDEX LED & CONN.
CLIP, CORD
SCREW, #6-32 x 5/16 BUT. HD. TORX DR.
SCREW, #6-32 x 3/16 PAN. HD. SLT. TORX DR.
WASHER, #6 EXTERNAL
ASSY, GROUND SPRING
BAR, FIXED

SEAGATE TECHNOLOGY

TITLE ST425 EXPLODED VIEW

DETAIL			RELEASED FOR ASSEMBLY
DESIGN			
APPRO			SHEET OF
	SCALE	PART NO.	EC LEVEL

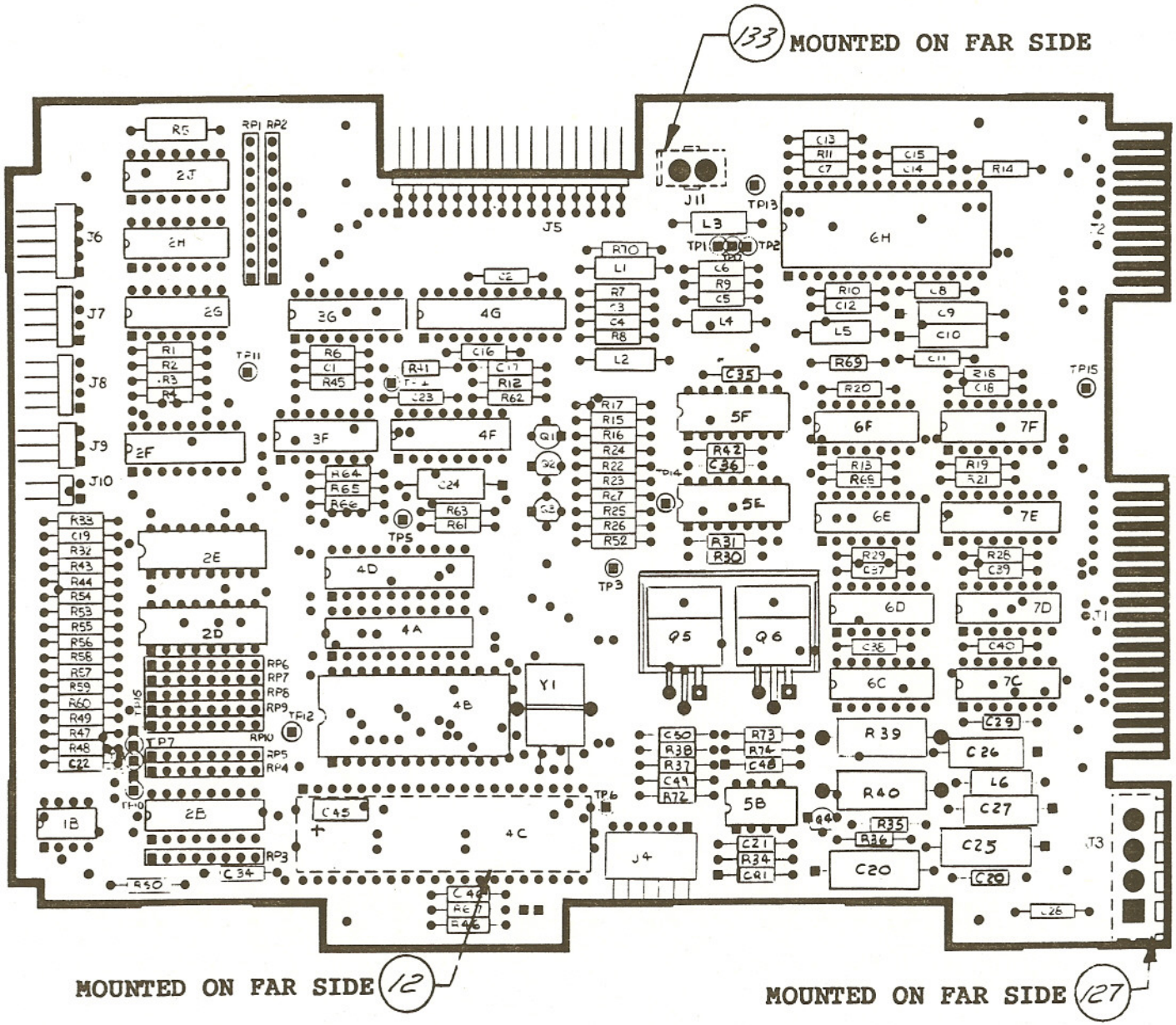


FIGURE 5.0
COMPONENT LOCATIONS

4.4

PRINTED CIRCUIT BOARD - PART NUMBER 20321-001

ITEM	QUANTITY	DESCRIPTION	LOCATION
1.	[2]	IC 7406	5E,6F
2.	[2]	74LS14	6D,3F
3.	[3]	7438	6C,7C,7F
4.	[3]	7445	2D,2E,2F
5.	[1]	7474	5F
6.	[1]	74123	4F
7.	[2]	74LS273	4A,4D
8.	[1]	LM393	1B
9.	[1]	6500/1	4C
10.	[1]	Diode Array	3G
11.	[1]	Pre-Amp	4G
12.	[1]	Motor Spin Control LSI	5B
13.	[1]	Read/Write LSI	6H
14.	[1]	MM2716 (2K x 8E PROM)	4B
15.	[1]	Stepper Motor Drive Ckt.	2B
16.	[1]	IC 7408	6E
17.	[1]	Shunt, 7 Position	7E
18.	[2]	Trans. Array TPQ2907	2H,2J
19.	[1]	Resistor Pack,14 Pin DIP, 220/330 Ohm	7D
20.	[1]	Resistor Pack,14 Pin DIP,680/1.2K Ohm	2G
21.	[1]	CAP,Ceramic 100 pf, 5%, NPO	C5
22.	[1]	330 pf	C6
23.	[1]	270 pf	C12
24.	[1]	39 pf	C13
25.	[1]	47 pf	C14
26.	[1]	22 uf,5%, NPO	C17
27.	[1]	.012 uf,10% X7R	C16
28.	[1]	.068 uf,10%,X7R	C18
29.	[26]	CAP,Ceramic .1 uf +80-20%	C4,7,8,15,19,21-23 28-41,43-46
30.	[2]	CAP,Electrolytic, 22 uf,16V	C20,25
31.	[5]	CAP,TANT, 4.7 uf, 35V, 10%	C9,11,24,26
32.	[1]	CAP,Ceramic .01 uf	C1
33.	[1]	CAP,Ceramic .33 uf, 50V, Z5U	C47
34.	[1]	Crystal, 2MHz, ±1%	Y1
35.	[1]	Diode, IN4005	CR1
36.	[2]	Inductor, 2.2 uh	L1,2
37.	[3]	Inductor, 10 uh	L3,4,6
38.	[1]	Inductor, 3.3 uh	L5
39.	[2]	Transistor, 2N3906	Q2,3
40.	[1]	Transistor, 2N3904	Q1,4
41.	[2]	Transistor, TIP120	Q5,6
42.	[1]	Resistor Pack,10 Pin SIP,1/4W,560 Ohm	RP1
43.	[1]	Resistor Pack,10 Pin SIP,1/4W,82 Ohm	RP2
44.	[2]	Resistor Pack,8 Pin SIP,1/2W,820 Ohm	RP5,10
45.	[1]	68 Ohm	RP6
46.	[1]	180 Ohm	RP7
47.	[1]	Resistor Pack,8 Pin SIP,1/2W 330 Ohm	RP8

PRINTED CIRCUIT BOARD - PART NUMBER 20321-001

48.	[1]	Resistor Pack,8 Pin SIP,1/2W,470 Ohm		RP9
49.	[2]	Resistor Pack,8 Pin,SIP,1W,10 Ohm		RP3,4
50.	[2]	Resistor, 2W, 5%, .2 Ohm		R39,40
51.	[1]	Resistor, 1/2W, 5%,	330 Ohm	R5
52.	[1]	Resistor, 1/8W, 1%,	357 Ohm	R9
53.	[2]		162 Ohm	R7,8
54.	[1]		30.1 Ohm	R16
55.	[1]		2.80 K Ohm	R24
56.	[1]		1.37 K Ohm	R27
57.	[2]		4.32 K Ohm	R47,49
58.	[1]		19.1 K Ohm	R64
59.	[1]		14 K Ohm	R65
60.	[1]	Resistor, 1/8W, 1%,	10 K Ohm	R66
61.	[1]	Resistor, 1/8W,	0 Ohm	R21
62.	[1]	Resistor, 1/8W, 1%,	54.9 Ohm	R15
63.	[2]	Resistor, 1/4W, 5%.	1.2 K Ohm	R1,3
64.	[2]		680 Ohm	R2,4
65.	[1]		5.1 Ohm	R6
66.	[3]		100 Ohm	R14,32,71
67.	[2]		2.4 K Ohm	R11,48
68.	[9]		3.3 K Ohm	R13,17,18,20,22, 30,31,34
69.	[1]		47 Ohm	R18
70.	[2]		6.2 K Ohm	R23,26
71.	[1]		220 Ohm	R28
72.	[1]		330 Ohm	R29
73.	[1]		51 Ohm	R33
74.	[1]		10 K Ohm	R35
75.	[1]		470 Ohm	R36
76.	[2]		4.7 K Ohm	R37,38
77.	[4]		3 K Ohm	R41,67,68,69
78.	[3]		2 K Ohm	R42,46,61
79.	[1]		150 Ohm	R43
80.	[1]		100 K Ohm	R44
81.	[3]		47 K Ohm	R55,62,63
82.	[6]		1 K Ohm	R50,53-56,60
83.	[1]		39 K Ohm	R52
84.	[1]		12 K Ohm	R57
85.	[1]		8.2 K Ohm	R58
86.	[1]		300 K Ohm	R59
87.	[1]		510 Ohm	R12
88.	[1]		39 Ohm	R10
89.	[1]	Resistor, 1/4W, 5%,	22 Ohm	R70

5.0 FIELD SALES OFFICES

CORPORATE HEADQUARTERS
920 Disc Drive
Scotts Valley, CA 95066
408/438-6550 TELEX:176455 SEAGATE SCVL

NORTHWESTERN REGIONAL SALES
1150 North First Street, #130
San Jose, CA 95112
408/286-7580

SOUTHWEST REGIONAL SALES
5850 Canoga Avenue, Suite 400
Woodland Hills, CA 91367
213/884-2699

CENTRAL REGION SALES
9451 LBJ Freeway, Suite 220
Dallas, TX 75243
214/783-6711 TWX:758760

EASTERN REGIONAL SALES
435 King Street
Littleton, MA 01460
617/486-9711

SOUTHWEST REGIONAL SALES
9700 Koger Blvd., Suite 310
St. Petersburg, FL 33702
813/577-1199 Telex:709049 Seagate UD

EUROPEAN HEADQUARTERS
Gassnerstrasse 5
8000 Munich
West Germany
49 89 177017 TELEX:524275